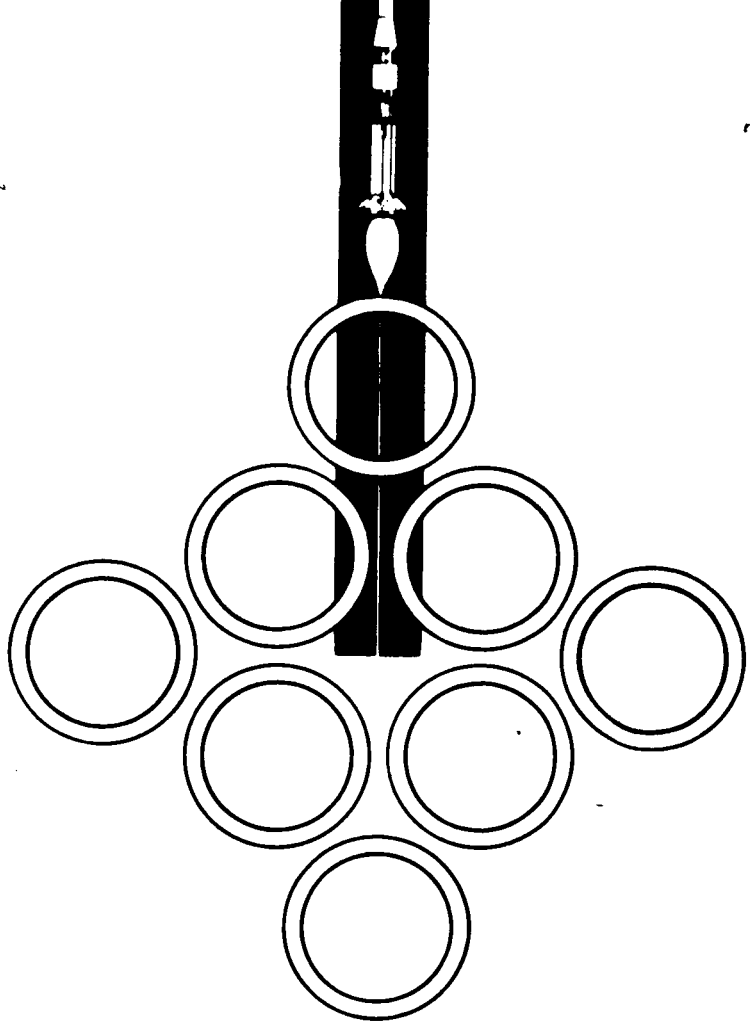

ENGINEERING DEPARTMENT

TECHNICAL REPORT

TR-RE-CCSD-FO-1020-3

April 3, 1967

SATURN IB PROGRAM

TEST REPORT FOR

PRESSURE REGULATORS

Grove Valve and Regulator Company Part Numbers T-1538 and T-1541

NASA Drawing Numbers B75M50305-1 and B75M50305-4

SPACE DIVISION CHRYSLER CORPORATION

TEST REPORT

FOR

PRESSURE REGULATORS

Grove Valve and Regulator Company Part Numbers T-1538 and T-1541

NASA Drawing Numbers B75M50305-1 and B75M50305-4

ABSTRACT

This report presents the results of tests performed on two **specimens each** of Pressure Regulators B75M50305-1 and B75M50305-4. The regulators differ only in orifice size. The B75M50305-1 has a 3/8-inch orifice, while the B75M50305-4 has a 1-inch orifice. The following tests were performed.

1. Receiving Inspection
2. Proof Pressure
3. Functional
4. Prolonged Pressure
5. Low Temperature
6. High Temperature

The specimen performance was in accordance with the specification requirements of NASA drawing B75M50305 with the following exceptions:

1. The proof pressure of 9000 psig, applied to specimen 1 at all three ports simultaneously, resulted in permanent structural deformation of the regulator dome and body. The dome and outlet proof pressure requirement was reduced to 5250 psig. No permanent structural deformation resulted on samples 2, 3, and 4 after this revision. However, all three leaked excessively at the body plug at an inlet pressure above 8000 psig.

2. The low temperature test resulted in excessive external leakage at the dome and regulator body interface. It was determined that this external leakage occurred at specimen temperatures of +5°F and below. Some of the body bolt torque values were below the specified value when measured at low temperature.

3. The high temperature test resulted in excessive external leakage at the regulator body plug. The body plug torque values were below the specified value when measured at high temperature.

TEST REPORT

FOR

PRESSURE REGULATORS

Grove Valve and Regulator Company Part Numbers T-1538 and T-1541

NASA Drawing Numbers B75M50305-1 and B75M50305-4

April 3, 1967

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

FOREWORD

The tests reported herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under contract NAS 8-4016, Part VII, CWO 271620.

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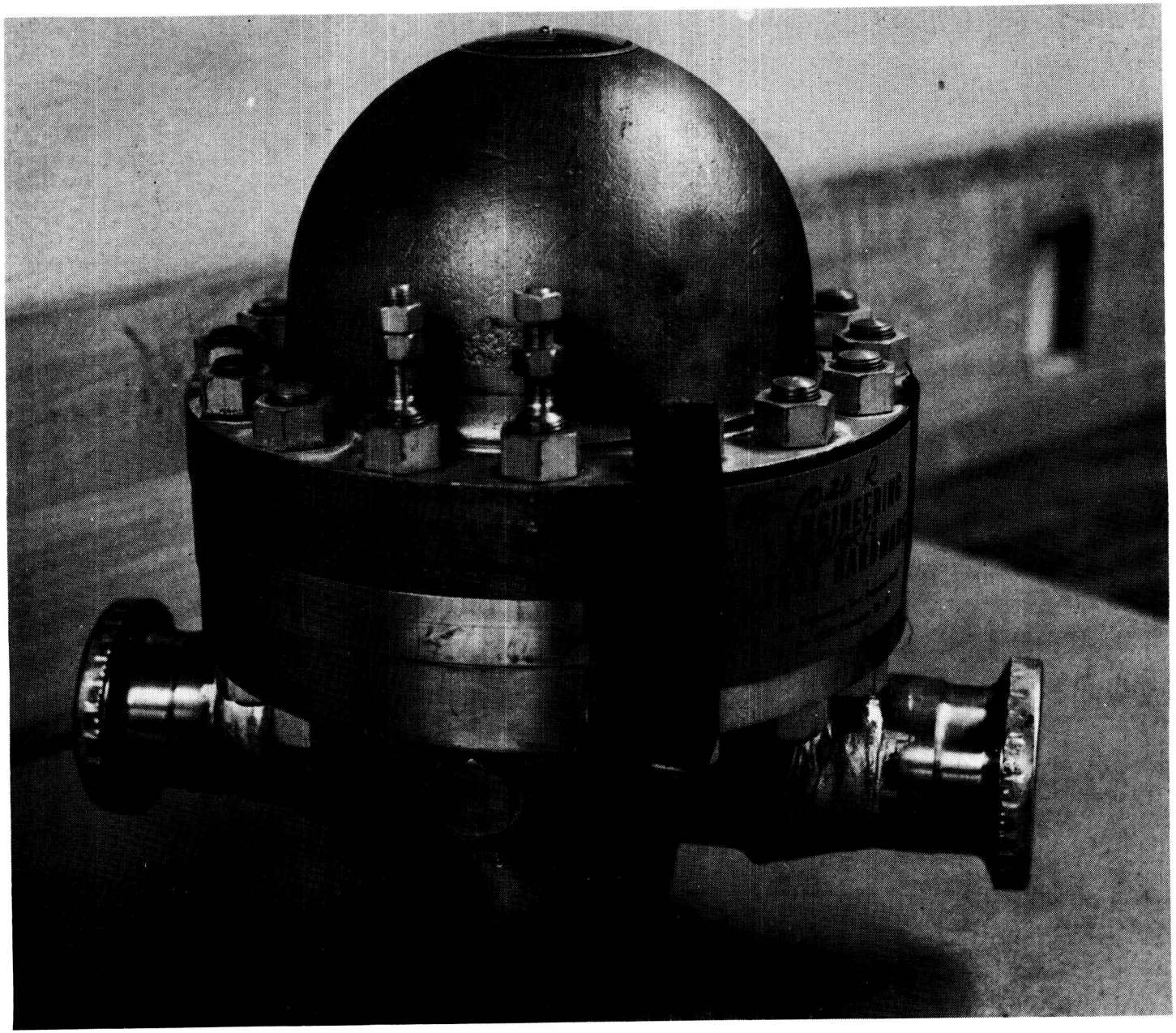


Pressure Regulator

CHECK SHEET

FOR

PRESSURE REGULATORS

MANUFACTURER: Grove Valve and Regulator Company
MANUFACTURER'S PART NUMBERS: T-1538 and T-1541
NASA DRAWING NUMBERS: B75M50305-1,Rev.K, B75M50305-4, Rev. K
TESTING AGENCY: Chrysler Corporation Space Division, New Orleans, Louisiana
AUTHORIZING AGENCY: NASA KSC

I. FUNCTIONAL REQUIREMENTS

A. OPERATING PRESSURE:	
1. INLET PRESSURE:	6000 psig maximum
2. OUTLET PRESSURE:	0 to 3500 psig
B. PROOF PRESSURE:	9000 psig inlet, 5250 psig dome and outlet
C. BURST PRESSURE:	24,000 psig
D. OPERATING MEDIUM:	Dry air, nitrogen, or helium
E. LEAKAGE:	Bubble tight
F. FLOW:	Monodirectional, orifice diameter - P/N T-1538, 3/8-inch P/N T-1541, 1-inch

II. CONSTRUCTION

A. MATERIAL:	Metal parts in flow stream are stainless steel. Nonmetallic parts in flow stream are nylon and Teflon.
1. BODY:	18/8 CRES
2. SEATS:	Nylon
3. DIAPHRAGM:	Nitrite rubber
4. O-RINGS:	Rev MIL-G-5510, MIL-P-5315 or MIL-P-5516
B. PNEUMATIC CONNECTIONS:	-
1. INLET:	1½ inch Grayloc, P/N GR14/XXS/316SS
2. OUTLET:	1½ inch Grayloc Flange, P/N GR14 160S 316SS
3. DOME:	Per MC240-4
C. MOUNTING ATTITUDE:	Dome flange in horizontal plane

III. ENVIRONMENTAL REQUIREMENTS

OPERATING TEMPERATURE:	-65 to +160°F

IV. SPECIAL REQUIREMENTS

CLEANING SPECIFICATION:	A10M01671, Level IV

V. LOCATION AND USE:

Pneumatic Distribution System to reduce storage vessel pressure to working pressure in pneumatic control distribution systems 1 and 2 for GN_2 and He.

TEST SUMMARY

PRESSURE REGULATORS

B75M50305-1 and B75M50305-4

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Receiving Inspection	4	Specifications and drawings	Conformance with drawings and specifications	Satisfactory	
Proof Pressure	4	9000 psig inlet 5250 psig outlet and dome	Check for leakage and distortion	Unsatisfactory	External leakage
Functional	4	6000 psig inlet 0 to 3500 psig outlet	Check seat and external leakage, repeatability, and stability	Satisfactory	Test completed
Prolonged Pressure	2	30 days	Determine if specimen operation is impaired by prolonged pressure	Satisfactory	Test completed
Low Temperature	2	-65 (+0, -4)°F	Determine if specimen operation is impaired by low temperature	Unsatisfactory	External leakage
High Temperature	2	160 (+4, -0)°F	Determine if specimen operation is impaired by high temperature	Unsatisfactory	External leakage

SECTION I

INTRODUCTION

1.1 SCOPE

1.1.1 This report presents the results of tests that were performed to determine if Pressure Regulators B75M50305-1, Rev K, and B75M50305-4, Rev K, meet the operational and environmental requirements for the John F. Kennedy Space Center Launch Complexes 34 and 37. A summary of the test results is presented on page viii.

1.1.2 Four pressure regulators (two B75M50305-1, Rev K, and two B75M50305-4, Rev K) were numbered specimens 1 through 4 for identification purposes; specimens 1 and 2 refer to B75M50305-1, Rev K, and 3 and 4 refer to B75M50305-4, Rev K. See table 2-2 for specimen serial numbers.

1.2 ITEM DESCRIPTION

1.2.1 Pressure Regulators B75M50305 are dome-loaded pneumatic regulators. They are designed for use with dry air, gaseous nitrogen, or helium. Orifices of 0.375 and 1.000 inch are in B75M50305-1 and B75M50305-4, respectively. The regulators are designed to reduce an inlet pressure of 6000 psig to an outlet pressure ranging from 0 to 3500 psig. The regulators are manufactured by Grove Valve and Regulator Company.

1.3 APPLICABLE DOCUMENTS

1.3.1 The documents used in this test report are as follows:

a. 75M50305, Rev K, Component Specification

b. KSC-STD-164(D), Environmental Test Methods

c. A1OM01671, Cleanliness Requirement

d. Test Plan CCSD-FO-1020-1R, Test Requirements

e. Test Procedure TP-RE-CCSD-FO-1020-2R

SECTION II

RECEIVING INSPECTION

2.1 REQUIREMENTS

2.1.1 Test specimens 1 and 2 shall be checked for conformance with NASA drawing B75M50305-1, Rev K, and applicable specifications. Test specimens 3 and 4 shall be checked for conformance with NASA drawing B75M50305-4, Rev K, and applicable specifications. Each specimen shall be checked to the extent possible without disassembly of the test specimen and shall also be inspected for poor workmanship and manufacturing defects. The specimens shall be checked for vendor certification of the presence of the dome plate with a spiraled groove.

2.2 PROCEDURE

Specimens 1 and 2 were checked for conformance with NASA drawing B75M50305-1, Rev K, and specimens 3 and 4 were checked for conformance with NASA drawing B75M50305-4, Rev K.

2.2.2 Checks were made for defective threads and welds.

2.2.3 Checks were made for damage to end fittings.

2.3 TEST RESULTS

The receiving inspection test results were satisfactory.

2.4 TEST DATA

The dimensional data are presented in table 2-2.

Table 2-1. Receiving Inspection Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Scale	Brown and Sharpe	300-24"	NASA 101-1013	24 inches long Cal date 7-23-64
2	Micrometer	Starrett	239 3"-4'	NASA 49-1611-A	3 to 4 inch range Cal date 8-16-66
3	Micrometer	Starrett	436 13"-14"	NASA 49-1375-A	13 to 14 inch range Cal date 9-6-66
4	Calipers	Union Tool	NA	NA	Internal

Table 2-2. Dimensional Data

Dimension*	Allowable (Inches)	Specimen (Inches)			
		1 S/N 106869-1	2 S/N 106869-2	3 S/N 106870-1	4 S/N 106870-2
A	10-1/4 (±1/32) Dia.	10-7/32	10-1/4	10-7/32	10-7/32
B_O	1.338 (±1/16) I.D. Dia.	1.340	1.350	1.360	1.350
B_I	1.100 (±1/16) I.D. Dia.	1.100	1.100	1.125	1.120
C	14 (±1/8)	13.981	13.953	13.988	14.105
D	13-1/2 (±1/16)	13.524	13.458	13.50	13.420
E_O	3.125 (±1/16) O.D. Dia.	3.1245	3.126	3.1270	3.126
E_I	3.125 (±1/16) O.D. Dia.	3.1245	3.1225	3.1270	3.123

*** See figure 2-1 for dimensions identification.**

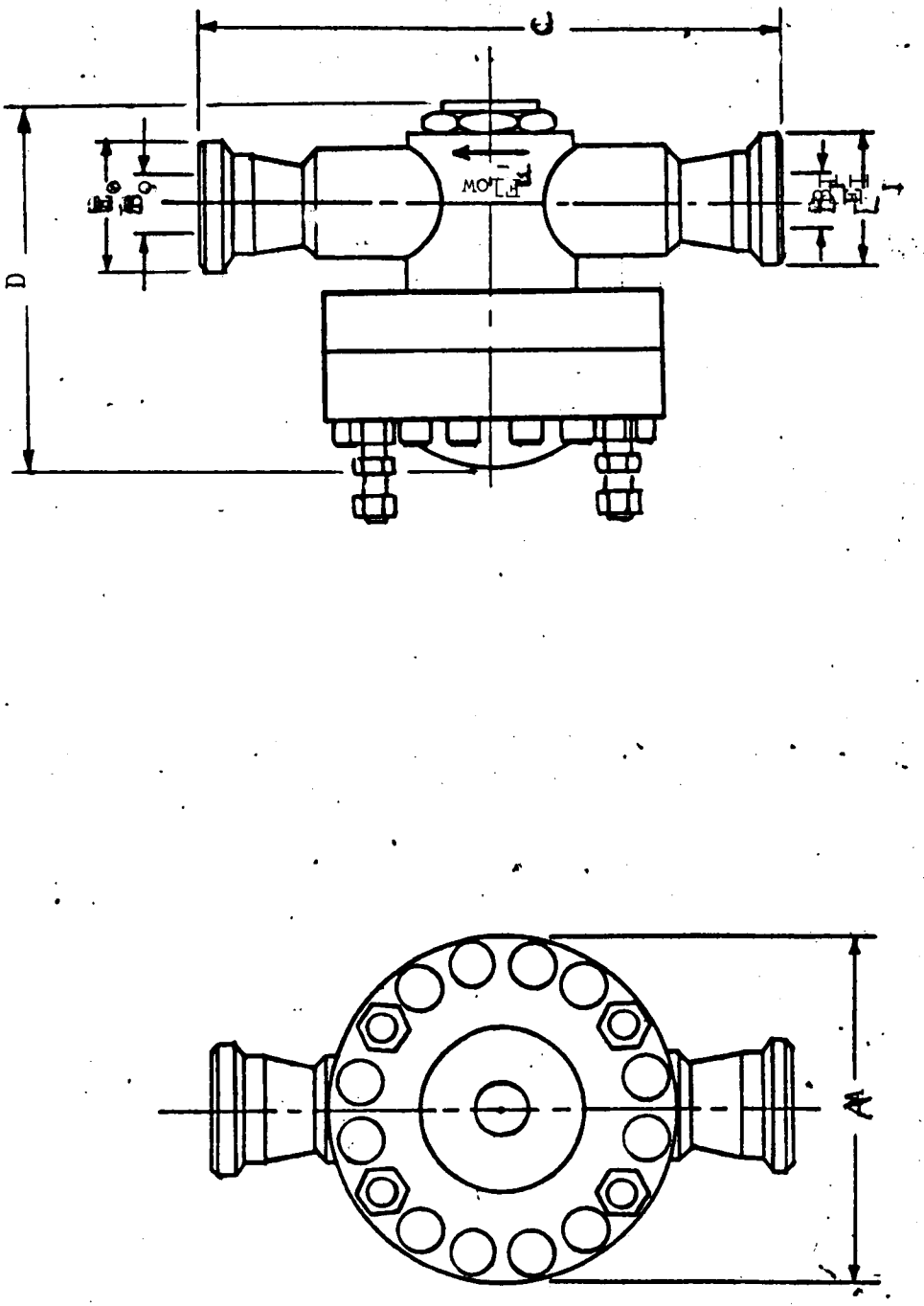


Figure 2-1. Dimensions For Receiving Inspection Test

Figure 2-2. Receiving Inspection

SECTION III

PROOF PRESSURE TEST

3.1 TEST REQUIREMENTS

3.1.1 Each specimen shall be subjected to a proof pressure of 9000 psig at the inlet and 5250 psig at the dome and outlet.*

3.1.2 Proof pressure shall be maintained for 5 minutes.

3.1.3 Leakage shall be monitored during this test.

3.2 TEST PROCEDURE

3.2.1 The proof pressure test setup was assembled as shown in figures 3-1 and 3-5 using the equipment listed in table 3-1.

3.2.2 Regulator 4 was adjusted for zero outlet pressure. Hand valves 6 and 7 were closed.

3.2.3 Hand valve 9 was slowly opened. Gage 10 indicated 10,000 psig.

3.2.4 Regulator 4 was adjusted to provide an outlet pressure of 9000 psig as indicated on gage 5.* This pressurized the inlet port of the test specimen.

3.2.5 This proof pressure was maintained for 5 minutes. Leakage was monitored by checking for bubbles in the water tank. No leakage is allowed.

3.2.6 Hand valve 9 was closed.

3.2.7 Hand valve 6 was slowly opened to vent the system.

3.2.8 The specimen was examined for damage or deformation resulting from this test.

3.2.9 Regulator 4 was adjusted for zero outlet pressure. Hand valves 6 and 11 were closed. Hand valve 7 was opened.

3.2.10 Hand valve 9 was slowly opened. Gage 4 indicated 10,000 psig.

3.2.11 Regulator 4 was adjusted to provide an outlet pressure of 5250 psig ad indicated on gage 5. This simultaneously pressurized the inlet, outlet, and dome parts of the specimen.

3.2.12 A proof pressure of 5250 psig was maintained for 5 minutes. Leakage was monitored by checking for bubbles in the water tank. No leakage is allowed.

* Note: The proof pressure requirement was originally 9000 psig on the outlet, inlet, and dome.

3.2.13 Hand valve 9 was closed.

3.2.14 Hand valve 3 was slowly opened to vent the system.

3.2.15 The specimen was examined for damage or distortion resulting from this test.

3.3 TEST RESULTS

3.3.1 Sample 1 was proof pressure tested to the original test requirement of 9000 psig on all ports. The dome O-ring seal ruptured at 8800 psig. The dome O-ring is shown in figure 3-2. Further investigation revealed that the valve body and the dome had permanently deformed. This is shown in figures 3-3 and 3-4 respectively.

3.3.2 Samples 2, 3, and 4 were proof pressure tested as per the present test requirement. No structural deformation occurred, although all three leaked excessively at the body plug before the required inlet proof pressure was reached.

3.4 TEST DATA

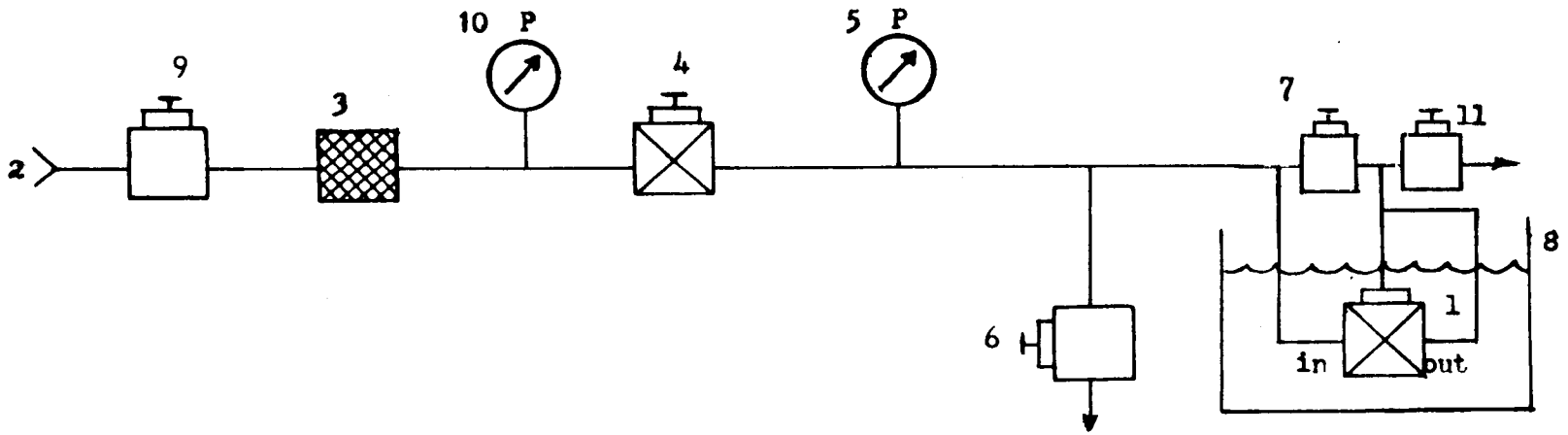
Proof pressure test data are presented in table 3-2.

Table 3-1. Proof Pressure Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Specimen 1	Grove Valve and Regulator	T-1538	106869-1	Dome regulator
	Specimen 2	Grove Valve and Regulator	T-1538	106869-2	Dome regulator
	Specimen 3	Grove Valve and Regulator	T-1541	106870-1	Dome regulator
	Specimen 4	Grove Valve and Regulator	T-1541	107870-2	Dome regulator
2	GN_2 Source	CCSD			10,000-psig
3	Filter	Microporous	4813-2DM		2-micron
4	Regulator	Tescom Corp.	26-1021-20	3024	10,000-psig inlet 0-to 10,000-psig outlet
5	Pressure Gage	Heise	H34955	014231	0-to 10,00-psig ±0.25% FS Cal date 10/30/66
6	Hand Valve	Grove	KA 2B		10,000-psig
7	Hand Valve	Grove	KA 2B		10,000-psig
8	Tank	Local Mfg.			Detonized water
9	Hand Valve	Grove	KA 2B		10,000-psig
10	Pressure Gage	Ashcroft		200613-	0-to 20,000-psig ±0.25% FS Cal date 10/30/66
11	Hand Valve	Grove	KA 2B		10,000-psig

Table 3-2. Proof Pressure Test Data

Specimen	Proof Pressure (psig)		Pressurization Time	Results
	Inlet	Outlet/Dome		
1	8800	8800	NA	Dome seal ruptured at 8800 psig
2	9000	5250	5	Excessive body plug leakage above 8300 psig
3	9000	5250	5	Excessive body plug leakage above 8200 psig
4	9000	5250	5	Excessive body plug leakage above 7400 psig



Note: All lines ¼ inch.
Refer to table 3-1 for item identification.

Figure 3-1. Proof Pressure Test Schematic

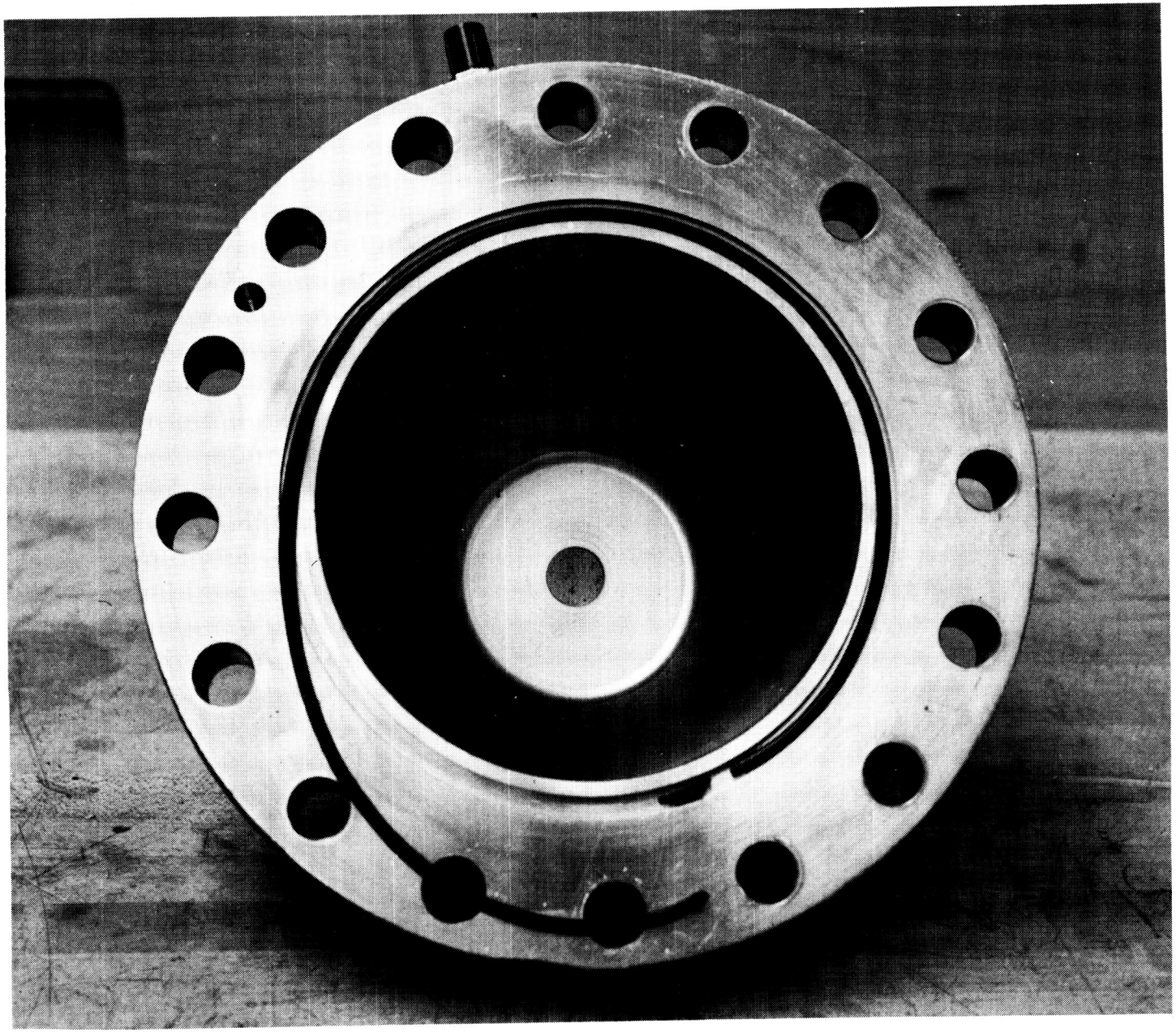


Figure 3-2. Dome O-Ring Seal Failure

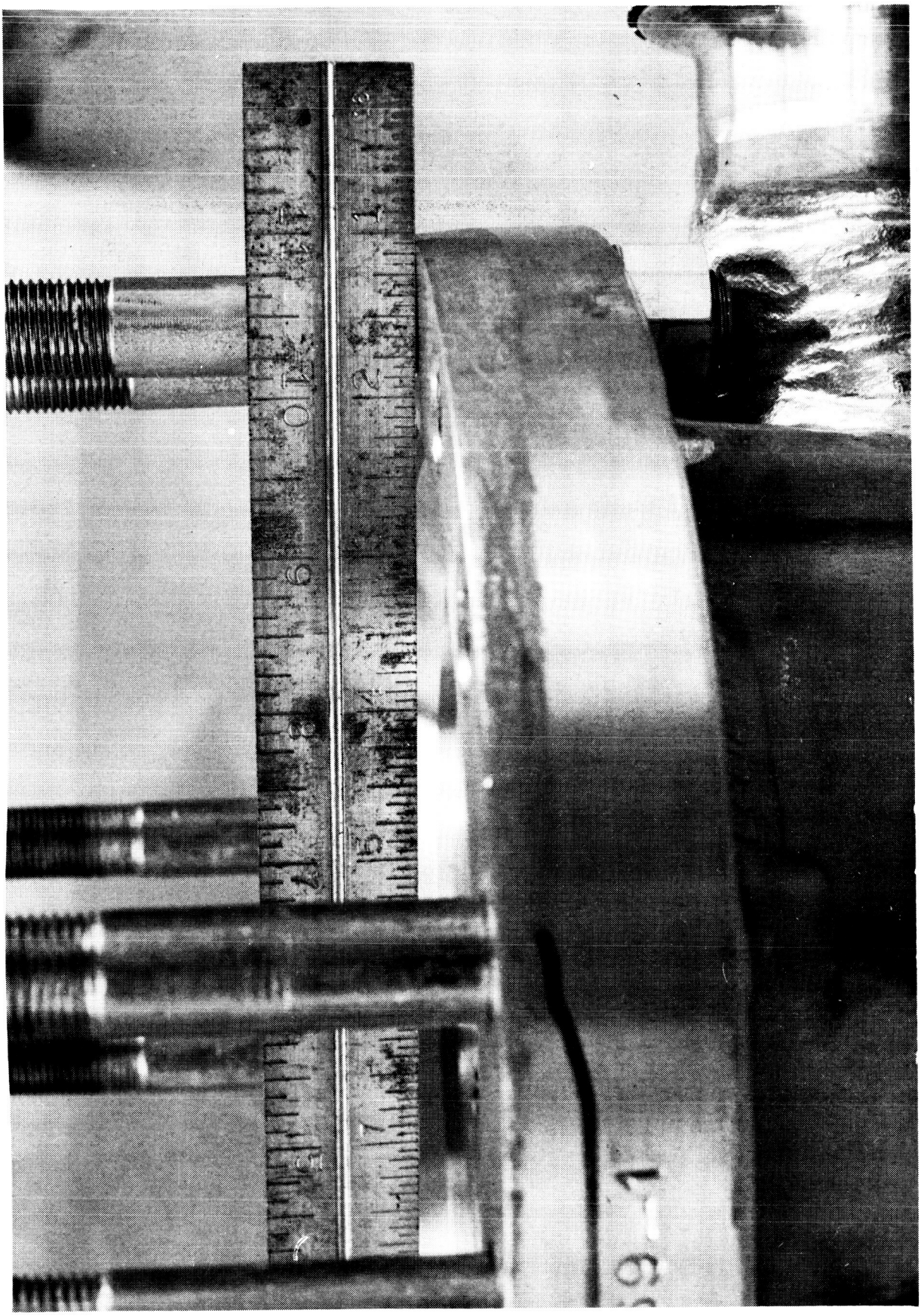


Figure 3-3. Deformed Regulator Body

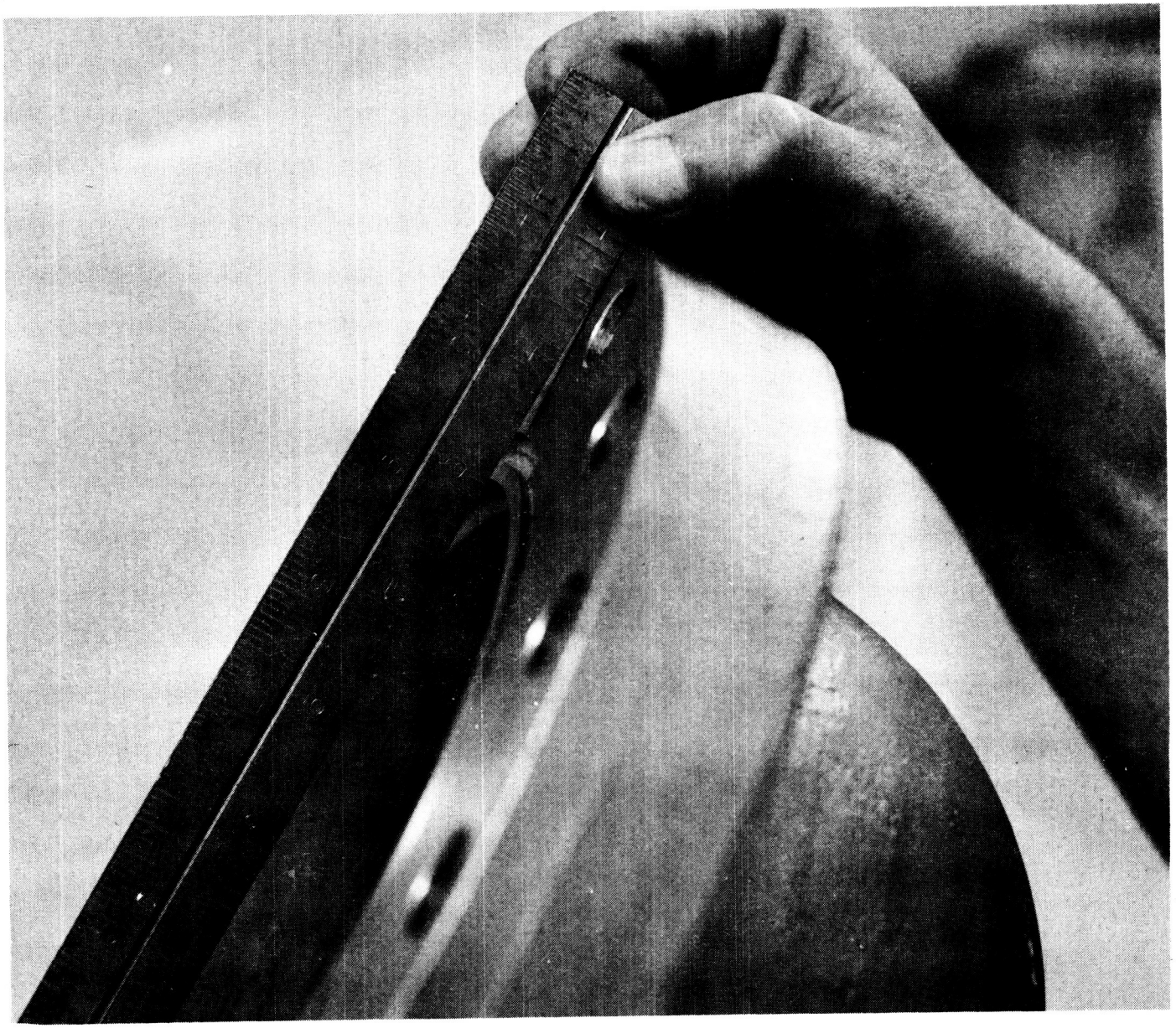


Figure 3-4. Deformed Dome

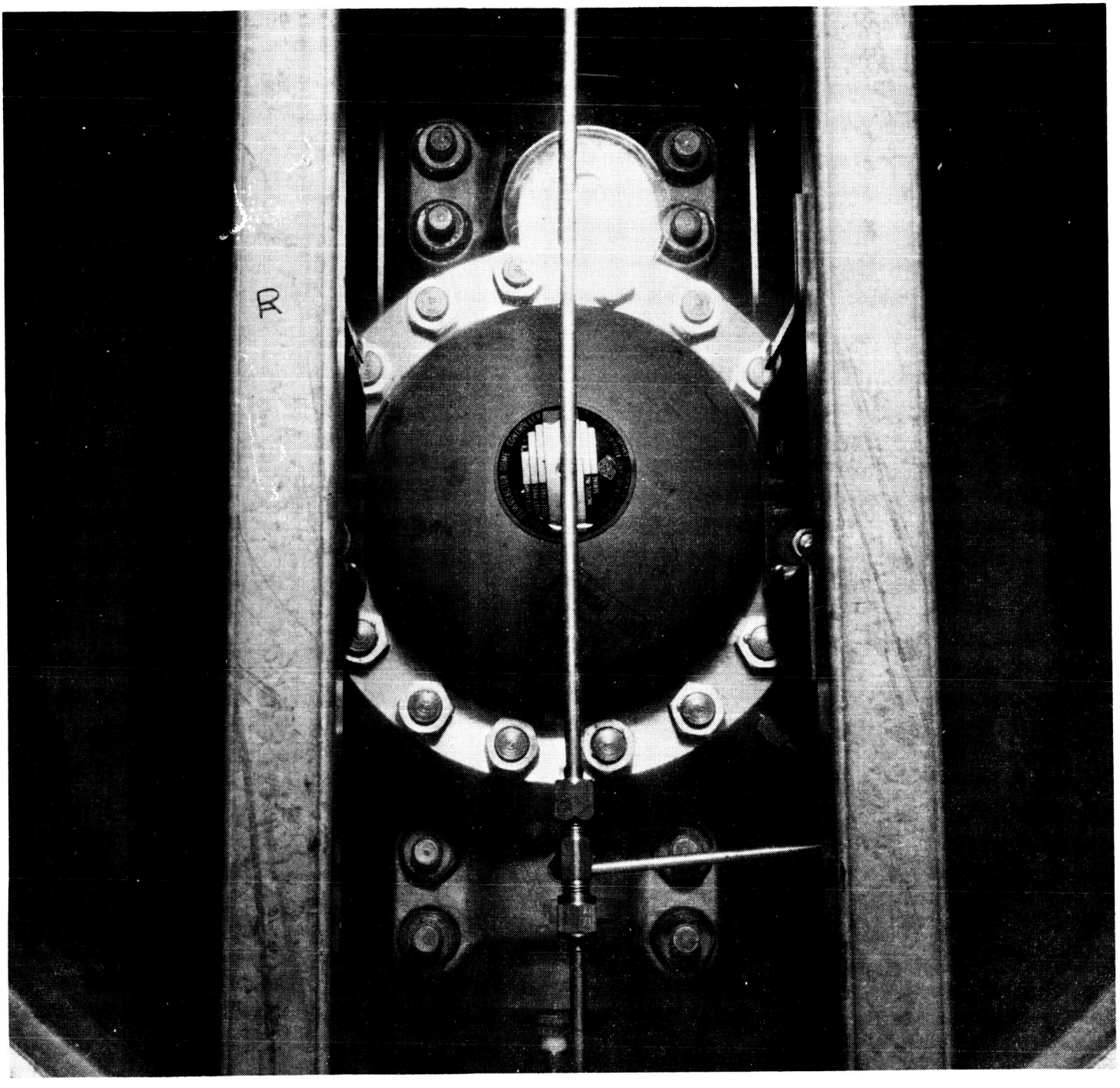


Figure 3-5. Proof Pressure Test Setup

SECTION IV

FUNCTIONAL TEST

4.1 TEST REQUIREMENTS

4.1.1 With the specimen set for zero flow and its inlet port pressurized to 6000 psig, the specimen shall be checked for internal and external leakage.

4.1.2 With the outlet port of the specimen pressurized to 3000 ($\pm$40) psig, the specimen shall be checked for leakage into the dome. No leakage shall be allowed.

4.1.3 With the dome of the test specimen pressurized to 500 ($\pm$10) psig, the specimen shall be checked for leakage past the diaphragm. No leakage shall be allowed.

4.1.4 With the inlet port of the specimen pressurized to 6000 psig and the dome pressure set to yield an outlet pressure of 750 psig, determine that the dome pressure agrees with the following formula within $\pm$5 per cent:

Specimens 1 and 2: $$P_{dome} = 0.3 \frac{(P_{inlet} - P_{outlet})}{100} + P_{outlet}$$

Specimens 3 and 4: $$P_{dome} = 2.0 \frac{(P_{inlet} - P_{outlet})}{100} + P_{outlet}$$

Check for repeatability of the dome pressure by cycling the downstream shutoff valve five times. Outlet and dome pressure shall return to within $\pm$2 per cent when the downstream valve is closed.

4.1.5 With the inlet port of the specimen pressurized to 6000 psig, the dome pressure shall be cycled five times with outlet port vented from zero to the pressure determined in 4.1.4. After the fifth cycle, a leakage check shall be made between the inlet and outlet ports (10 sccm maximum leakage is allowable).

4.1.6 The procedures described in paragraphs 4.1.4 and 4.1.5 shall be repeated for outlet pressures of 1500 psig and 3000 psig.

4.1.7 The initial functional test shall be performed three times each with GN_2 and GHe as test media. All subsequent functional tests shall be performed three times with GN_2 as the only test medium, except where specified.

4.2 TEST PROCEDURE

4.2.1 The functional test setup was assembled as shown in figures 4-1 and 4-2 using the equipment listed in table 4-1.

4.2.2 All hand valves were closed and all regulators were adjusted for zero outlet pressure.

4.2.3 Hand valves 11, 17, 19, 29, 30 and 33 were opened.

4.2.4 Regulator 7 was adjusted as required to load regulator 7A to provide a specimen inlet pressure, as indicated on gage 9, of 6000 psig. This pressure was maintained for 5 minutes while monitoring flowmeter 18 for leakage. Maximum allowable leakage is 10 sccm.

4.2.5 During this period, a check was made for specimen external leakage by using soap solution. No external leakage is allowed.

4.2.6 Hand valve 17 was closed.

4.2.7 Hand valve 23 was opened. Regulator 7 was readjusted as required to load regulator 7A to provide 4500 psig as indicated by gage 9.

4.2.8 Hand valves 12 and 35 were slowly opened. Gages 9 and 13 indicated 4500 psig. This condition was maintained for five minutes while checking for leakage (utilizing water displacement method) into the dome. No bubble leakage is allowed.

4.2.9 Regulator 7 was adjusted to provide zero outlet pressure. Hand valve 36 was cracked to vent pressure until gages 9 and 13 indicated zero pressure. Hand valve 17 was opened. Hand valves 23 and 36 were closed.

4.2.10 Hand valves 10, 20, and 32 were opened. Regulator 6 was adjusted to provide a specimen dome pressure of 3000 psig as indicated by gages 8 and 37. This pressure was maintained for 5 minutes while checking for leakage past the diaphragm. No leakage is allowed.

4.2.11 Regulator 6 was adjusted for zero outlet pressure. Hand valve 27 was cracked to vent pressure until gage 37 indicated zero pressure. Hand valves 12, 17, and 27 were closed.

4.2.12 Regulator 7A was adjusted to provide a specimen inlet pressure, as indicated by gage 9, of 6000 psig.

4.2.13 Regulator 6 was adjusted to pressurize the specimen dome until a specimen outlet pressure of 750 psig, as indicated on gage 13, was obtained.

4.2.14 Specimen dome pressure was recorded as indicated on gage 8. This value was compared with the theoretical dome pressure as calculated using the formula in 4.1.4. The actual dome pressure must be within ± 5 per cent of the theoretical pressure.

4.2.15 Solenoid valve 14 was opened and closed for five cycles. Then, with solenoid valve 14 closed, the pressures indicated on gages 13 and 38 were within ±2 per cent of the previous recorded pressures.

4.2.16 Regulator 6 was adjusted for zero outlet pressure. Hand valve 27 was cracked to vent pressure until gage 8 indicated zero pressure. Hand valve 27 was closed.

4.2.17 Hand valve 36 was cracked to vent specimen outlet pressure until gage 13 indicated zero pressure. Solenoid valve 14 was opened and hand valve 36 was closed.

4.2.18 Using regulator 6 and hand valve 27, the specimen dome was alternately pressurized to the actual pressure determined in 4.2.14 and vented to zero for five cycles. After the last cycle, gage 8 indicated zero pressure, and gage 9 indicated 6000 psig. While maintaining these conditions, hand valve 17 was opened and solenoid valve 14 was closed. Flowmeter 18 was monitored for indication of leakage. The maximum leakage allowable is 10 sccm.

4.2.19 Hand valves 17 and 27 were closed.

4.2.20 The procedures described in 4.2.13 through 4.2.19 were repeated using a specimen outlet pressure of 1500 psig.

4.2.21 The procedures described in 4.2.13 through 4.2.19 were repeated using a specimen outlet pressure of 3000 psig.

4.2.22 For the initial functional test, the steps in paragraphs 4.2.1 through 4.2.21 were repeated three times using GHe as test medium and three times using GN_2 as test medium. For all subsequent functionals, steps in paragraphs 4.2.1 through 4.2.21 were repeated three times using only GN_2 as test medium unless otherwise specified.

4.2.23 Upon completion of the last test, hand valves 19 and 20 were closed. Hand valve 34 was opened. Hand valve 12 was slowly opened. Hand valve 27 was opened and regulator 6 was adjusted for maximum outlet pressure. All gages indicated zero pressure.

4.2.24 The specimen was visually examined for evidence of damage or distortion.

4.2.25 All test data were recorded.

4.3 TEST RESULTS

Samples 2, 3 and 4 completed the initial functional test satisfactorily.

4.4 TEST DATA

4.4.1 Initial functional test data are shown in tables 4-2, 4-3 and 4-4.

Table 4-1. Functional Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Specimen 1	Grove Valve and Regulator	T-1538	106869-1	Dome regulator
	Specimen 2	Grove Valve and Regulator	T-1538	106869-2	Dome regulator
	Specimen 3	Grove Valve and Regulator	T-1541	106870-1	Dome regulator
	Specimen 4	Grove Valve and Regulator	T-1541	106870-2	Dome regulator
2	GH_2 & GN_2 Source	CCSD			10,000-psig
3	GH_2 & GN_2 Source	CCSD			10,000-psig
4	Filter	Fluid Dynamics	FL-20-8 BB		2-micron
5	Filter	Fluid Dynamics	FL-20-8 BB		2-micron
6	Regulator	Tescom Corp	26-1021-20	3024	10,000-psig inlet 0-to 10,000-psig outlet
7	Regulator	Tescom	26-1021-10	1529	10,000-psig inlet 0-to 10,000-psig outlet
7A	Dome Regulator	Grove	201-B	RA-7049	10,000-psig inlet 0-to 10,000-psig outlet
8	Pressure Gage	Heise	H34955	014231	0-to 10,000-psig ±0.1% FS Cal date 10/31/66
9	Pressure Gage	Heise	H35838	200595-P	0-to 10,000-psig ±0.1 FS Cal date 10/31/66

Table 4-1. Functional Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
10	Hand Valve	Aminco	13126	NA	30,000-psig ±0.1% FS Cal date 10-3-66
11	Hand Valve	Grove	KA2B	NA	10,000-psig
12	Hand Valve	Robbins	SSKG-250 -4T	NA	10,000-psig
13	Pressure Gage	Heise	H35840	200616E	10,000-psig ±0.25% FS Cal date 12-1-66
14	Solenoid Valve	Marotta	MV583	370	6000-psig
15	Switch	Ind. Lab., Inc.	NA	NA	SPST
16	Power Supply	Perkin	MRST-28-300	63-293	28-vdc
17	Hand Valve	Robbins	SSKG-250 -4T	NA	6000-psig
18	Flowmeter	Local Mfg.	NA	NA	Water displacement
19	Hand Valve	Grove	KA2B	NA	10,000-psig
20	Hand Valve	Aminco	13126	NA	30,000-psig
21	Pressure Gage	Ashcroft	NA	200613-3	0 to 20,000-psig
22	Pressure Gage	Ashcroft	NA	95-1508 -B	20,000-psig ±0.25% FS Cal date 10-11-66
23	Hand Valve	Robbins	SSKG-250 -4T	NA	6000-psig
24	Flowmeter	Local Mfg.	NA	NA	Water displacement

Table 4-1. Functional Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
25	Temp. Chamber	Local Mfg.	NA	NA	NA
26	Thermocouple	Conax Corp.	Type T	NA	NA
27	Hand Valve	Aminco	13126	NA	30,000-psig
28	Pressure Gage	Ashcroft	NA	200613-10	0 to 10,000-psig ±0.25% FS Cal date 10-11-66
29	Hand Valve	Grove	KA2B	NA	10,000-psig
30	Hand Valve	Cardair	3510-0077	NA	10,000-psig
31	Hand Valve	Hoke	100 G	NA	30,000-psig
32	Hand Valve	Aminco	13126	NA	30,000-psig
33	Hand Valve	Robbins	SSKG-250-4T	NA	6000-psig
34	Hand Valve	Robbins	SSKG-250-4T	NA	6000-psig
35	Hand Valve	Robbins	SSKG-250-4T	NA	6000-psig
36	Hand Valve	Robbins	SSKG-250-4T	NA	6000-psig
37	Pressure Gage	Ashcroft	NA	95-1509-B	0 to 10,000-psig ±0.25% FS Cal date 10-11-66
38	Relief Valve	Anderson-Greenwood	83 JC	NA	6000-psig
39	Temp. Recorder	Honeywell	Y1530	019417	-110 to +525°F Cal date 11-23-66
40	Thermatron	Thermatron	NA	200895-13	-130 to +430°F Cal date 8-29-66

Table 4-1. Functional Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
41	Solenoid Valve	Marotta	MV583	380	6000-psig
42	Hand Valve	Grove	KA2B	NA	6000-psig
43	GN_2 Source	CCSD	NA	NA	3000-psig
44	Thermocouple	Honeywell	NA	NA	-150 to +400°F
45	Filter	Fluid Dynamics	FL-20-8 BB	NA	2-micron
46	LN_2 Source	Airco	150-5T	251	Portable 150-gallon

Table 4-2. Initial Functional Test Data For Specimen 2

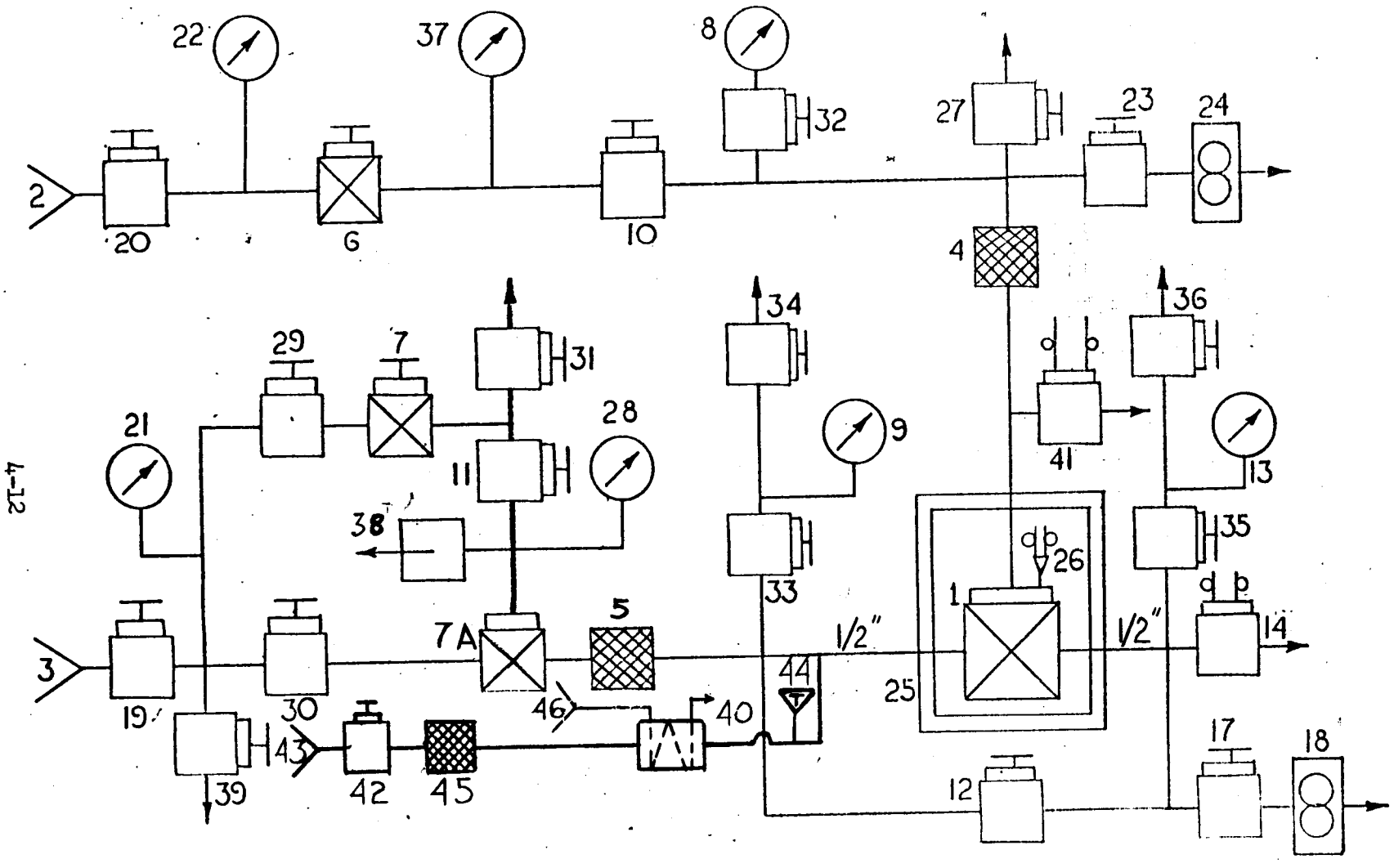
Test	Procedure Reference Paragraph	Allowable Value	Run	1	2	3	4	5	6
			Media	N_2	N_2	N_2	He	He	He
Seat Leakage	4.1.1	10 sccm		0	0	0	0	0	0
External Leakage	4.1.1	No leakage		0	0	0	0	0	0
Reverse Dome Leakage	4.1.2	No leakage		0	0	0	0	0	0
Forward Dome Leakage	4.1.3	No leakage		0	0	0	0	0	0
Actual Dome Pressure	4.1.4	±5% of calculated		780	780	780	775	780	775
Calculated Dome Pressure	4.1.4			765	765	765	765	765	765
Regulator Stability	4.1.4	±2% of dome and outlet pressure		OK	OK	OK	OK	OK	OK
Seat Leakage After Cycling 750-psig	4.1.5	10 sccm		0	0	0	0	0	0
Actual Dome Pressure	4.1.4	±5% of calculated		1530	1530	1520	1525	1515	1520
Calculated Dome Pressure	4.1.4			1513	1513	1513	1513	1513	1513
Regulator Stability	4.1.4	±2% of dome and outlet pressure		OK	OK	OK	OK	OK	OK
Seat Leakage After Cycling 1500-psig	4.1.5	10 sccm		0	0	0	0	0	0
Actual Dome Pressure	4.1.4	±5% of calculated		3010	3010	3010	3010	3010	3010
Calculated Dome Pressure	4.1.4			3009	3009	3009	3009	3009	3009
Regulator Stability	4.1.4	±2% of dome and outlet pressure		OK	OK	OK	OK	OK	OK
Seat Leakage After Cycling 3000-psig	4.1.5	10 sccm		0	0	0	0	0	0

Table 4-3. Initial Functional Test Data For Specimen 3

Test	Procedure Reference Paragraph	Allowable Value	Run	1	2	3	4	5	6
			Media	N_2	N_2	N_2	He	He	He
Seat Leakage	4.1.1	10 sccm		0	0	0	0	0	0
External Leakage	4.1.1	No leakage		0	0	0	0	0	0
Reverse Dome Leakage	4.1.2	No leakage		0	0	0	0	0	0
Forward Dome Leakage	4.1.3	No leakage		0	0	0	0	0	0
Actual Dome Pressure	4.1.4	±5% of calculated		870	870	860	870	870	870
Calculated Dome Pressure	4.1.4			855	855	855	855	855	855
Regulator Stability	4.1.4	±2% of dome and outlet pressure		OK	OK	OK	OK	OK	OK
Seat Leakage After Cycling 750-psig	4.1.5	10 sccm		0	0	0	0	0	0
Actual Dome Pressure	4.1.4	±5% of calculated		1600	1615	1590	---	---	---
Calculated Dome Pressure	4.1.4			1590	1590	1590	1590	1590	1590
Regulator Stability	4.1.4	±2% of dome and outlet pressure		OK	OK	OK	OK	OK	OK
Seat Leakage After Cycling 1500-psig	4.1.5	10 sccm		0	0	0	0	0	0
Actual Dome Pressure	4.1.4	±5% of calculated		3070	3070	3060	---	---	---
Calculated Dome Pressure	4.1.4			3060	3060	3060	3060	3060	3060
Regulator Stability	4.1.4	±2% of dome and outlet pressure		OK	OK	OK	OK	OK	OK
Seat Leakage After Cycling 3000-psig	4.1.5	10 sccm		0	0	0	0	0	0

Table 4-4. Initial Functional Test Data For Specimen 4

Test	Procedure Reference Paragraph	Allowable Value	Run 1	2	3	4	5	6
		Media	N_2	N_2	N_2	He	He	He
Seat Leakage	4.1.1	10 sccm	0	0	0	0	0	0
External Leakage	4.1.1	No leakage	0	0	0	0	0	0
Reverse Dome Leakage	4.1.2	No leakage	0	0	0	0	0	0
Forward Dome Leakage	4.1.3	No leakage	0	0	0	0	0	0
Actual Dome Pressure	4.1.4	±5% of calculated	870	875	870	865	860	865
Calculated Dome Pressure	4.1.4		855	855	855	855	855	855
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK	OK	OK	OK	OK	OK
Seat Leakage After Cycling 750-psig	4.1.5	10 sccm	0	0	0	0	0	0
Actual Dome Pressure	4.1.4	±5% of calculated	1590	1600	1595	1605	1610	1590
Calculated Dome Pressure	4.1.4		1590	1590	1590	1590	1590	1590
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK	OK	OK	OK	OK	OK
Seat Leakage After Cycling 1500-psig	4.1.5	10 sccm	0	0	0	0	0	0
Actual Dome Pressure	4.1.4	±5% of calculated	3070	3075	3070	3080	3070	3070
Calculated Dome Pressure	4.1.4		3060	3060	3060	3060	3060	3060
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK	OK	OK	OK	OK	OK
Seat Leakage After Cycling 3000-psig	4.1.5	10 sccm	0	0	0	0	0	0



Note: All lines 1/4-inch unless otherwise indicated.
Refer to table 4-1 for item identification.

Figure 4-1. Functional Test Schematic

SECTION V

PROLONGED PRESSURE TEST

5.1 TEST REQUIREMENTS

5.1.1 A prolonged pressure test will be performed on test specimens 2 and 4 while the specimens are pressurized with GHe to 6000 psig inlet port pressure and set to provide 3000 psig outlet port pressure to determine whether degradation or deformation occurs.

5.1.2 The prolonged pressure shall continue for 30 days.

5.1.3 External and internal leakage shall be monitored.

5.1.4 Monitor any fluctuation or variation in dome, inlet port, and outlet port pressure.

5.2 TEST PROCEDURE

5.2.1 The prolonged pressure test setup was assembled as shown in figures 5-1 and 5-2 using the equipment listed in table 5-1.

5.2.2 A functional test was performed because more than 72 hours had elapsed since the previous functional test.

5.2.3 All hand valves were closed and all regulators were adjusted for zero outlet pressure.

5.2.4 Hand valve 11 was opened. Regulator 7 was adjusted to provide a specimen inlet pressure, as indicated on gage 9, of 6000 psig, using GHe as the test medium.

5.2.5 Hand valve 15 was opened. Regulator 6 was adjusted to provide a specimen outlet pressure, as indicated on gage 19, of 3000 psig.

5.2.6 The conditions of 5.2.4 and 5.2.5 were maintained for 30 days. During this period, the specimen was examined for evidence of external or internal leakage and any variations in dome, inlet, and outlet pressure were noted.

5.2.7 Hand valves 11 and 15 were closed. Hand valves 13 and 14 were cracked until gages 9, 10, and 20 indicated zero pressure. Then, hand valve 17 was cracked until gages 8, 18 and 19 indicated zero pressure.

5.2.8 Immediately following this test, a functional test using GHe as the test medium was conducted.

5.2.9 Test data were recorded.

5.3 TEST RESULTS

Specimen 4 satisfactorily went through prolonged pressure test. The test was discontinued before specimen 2 was tested.

5.4 TEST DATA

5.4.1 The functional data prior to the prolonged pressure test are presented in table 5-2.

5.4.2 The functional data obtained immediately after the prolonged pressure test are presented in table 5-3.

5.4.3 The pressure fluctuation data recorded during the prolonged pressure test are presented in table 5-4.

Table 5-1. Prolonged Pressure Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Regulator	Accessory Products	140200-11/14	39, 40, 41, 42	Test specimen
2	GHe Source	NA	NA	NA	6000-psig
3	GHe Source	NA	NA	NA	6000-psig
4	Filter	Microporous	4813 F-2 DM	NA	2-micron
5	Filter	Microporous	4813 F-2 DM	NA	2-micron
6	Regulator	Tescom Corp.	26-1021-20	3024	10,000-psig inlet 0 to 10,000-psig outlet
7	Regulator	Tescom Corp.	26-1021-20	1529	10,000-psig inlet 0 to 10,000-psig outlet
8	Pressure Gage	Heise	H34955	014231	0 to 10,000-psig ±0.1% FS Cal date 10-31-66
9	Pressure Gage	Heise	H35838	200595-P	0 to 10,000-psig ±0.1 FS Cal date 10-31-66
10	Pressure Gage	Ashcroft	NA	200613-3	0 to 20,000-psig ±0.25% FS Cal date 10-11-66
11	Hand Valve	Grove	KA 2B	NA	10,000-psig
12	Hand Valve	Robbins	SSKG-250-4T	NA	6000-psig
13	Hand Valve	Robbins	SSKG-250-4T	NA	6000-psig

Table 5-1. Prolonged Pressure Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
14	Hand Valve	Robbins	SSKG-250 -4T	NA	6000-psig
15	Hand Valve	Aminco	13126	NA	30,000-psig
16	Hand Valve	Robbins	SSKG-250 -4T	NA	6000-psig
17	Hand Valve	Robbins	SSKG-250 -4T	NA	6000-psig
18	Pressure Gage	Ashcroft	NA	95-1509-B	0 to 10,000-psig ±0.25% FS Cal date 10-11-66
19	Pressure Gage	Seegers	2122-9	200506-A	6000-psig ±0.25% FS Cal date 12-9-66
20	Pressure Gage	Martin-Decker	8-760-600	106-1016 -B	6000-psig ±0.25% FS Cal date 12-30-66

Table 5-2. Specimen 4 Functional Test Data Before Prolonged Pressure Test

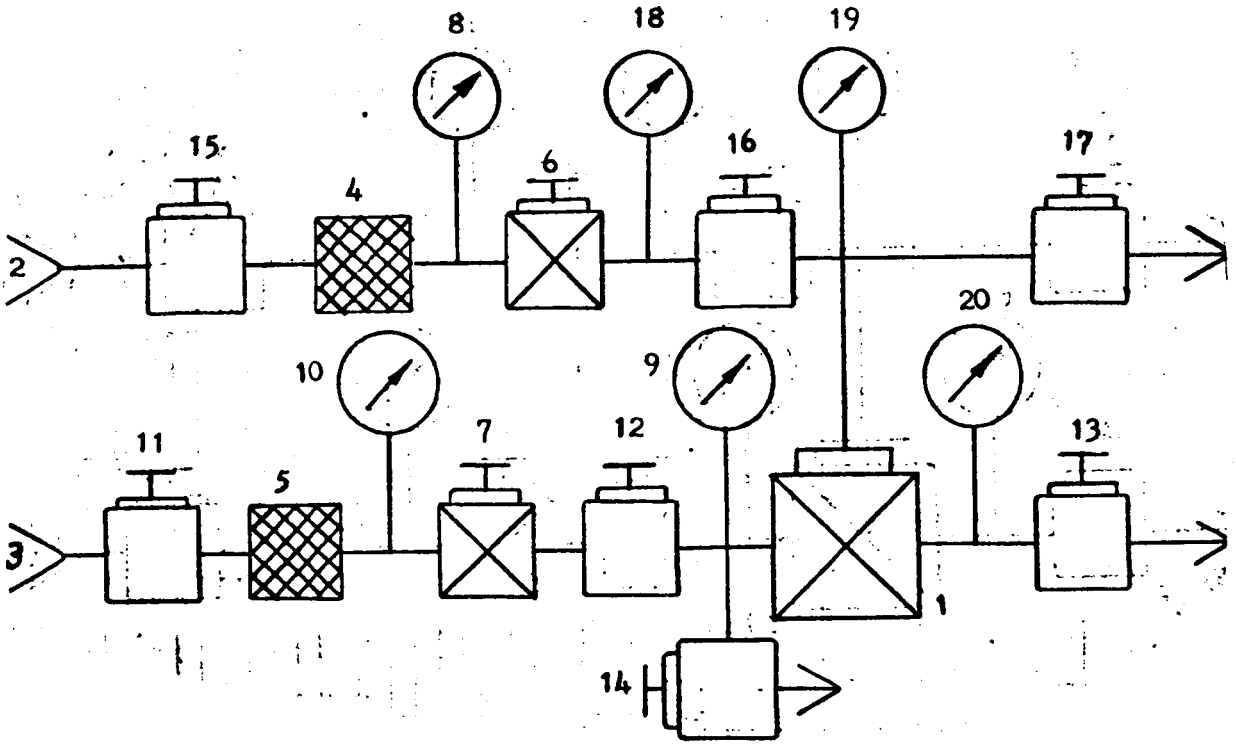
Test	Procedure Reference Paragraph	Media: Allowable Value	N_2: Actual Value
Seat Leakage	4.1.1	10 sccm	0
External Leakage	4.1.1	No leakage	0
Reverse Dome Leakage	4.1.2	No leakage	0
Forward Dome Leakage	4.1.3	No leakage	0
Actual Dome Pressure	4.1.4	±5% of calculated	860
Calculated Dome Pressure	4.1.4		855
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	1600
Calculated Dome Pressure	4.1.4		1590
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	3065
Calculated Dome Pressure	4.1.4		3060
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm	0

Table 5-3. Specimen 4 Functional Test Data After Prolonged Pressure Test

Test	Procedure Reference Paragraph	Media Allowable Value	N_2 Actual Value
Seat Leakage	4.1.1	10 sccm	0
External Leakage	4.1.1	No leakage	0
Reverse Dome Leakage	4.1.2	No leakage	0
Forward Dome Leakage	4.1.3	No leakage	0
Actual Dome Pressure	4.1.4	±5% of calculated	810
Calculated Dome Pressure	4.1.4		855
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	1580
Calculated Dome Pressure	4.1.4		1590
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	3045
Calculated Dome Pressure	4.1.4		3060
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm	0

Table 5-4. Pressure Fluctuation Data During Prolonged Pressure Test

Date	Inlet (psig)	Outlet (psig)	Dome (psig)	Date	Inlet (psig)	Outlet (psig)	Dome (psig)
10-31-66	6000	3000	3050	11-15-66	6010	3015	3065
11-1-66	5980	2990	3050	11-16-66	6010	3015	3065
11-2-66	5920	2960	3015	11-17-66	6015	3020	3075
11-3-66	5925	2960	3025	11-18-66	6005	3010	3070
11-4-66	5978	2982	3040	11-19-66	Saturday		
11-5-66	Saturday			11-20-66	Sunday		
11-6-66	Sunday			11-21-66	6000	3005	3065
11-7-66	6010	3015	3065	11-22-66	5995	3000	3060
11-8-66	6010	3015	3065	11-23-66	5993	3000	3060
11-9-66	6010	3015	3070	11-24-66	Thanksgiving Holiday		
11-10-66	6015	3020	3075	11-25-66	Thanksgiving Holiday		
11-11-66	6020	3020	3078	11-26-66	Saturday		
11-12-66	Saturday			11-27-66	Sunday		
11-13-66	Sunday			11-28-66	5900	2950	3030
11-14-66	6000	3000	3055	11-29-66	5910	2960	3035



Note: All lines 1/4-inch.
Refer to table 5-1 for item identification.

Figure 5-1. Prolonged Pressure Test Schematic

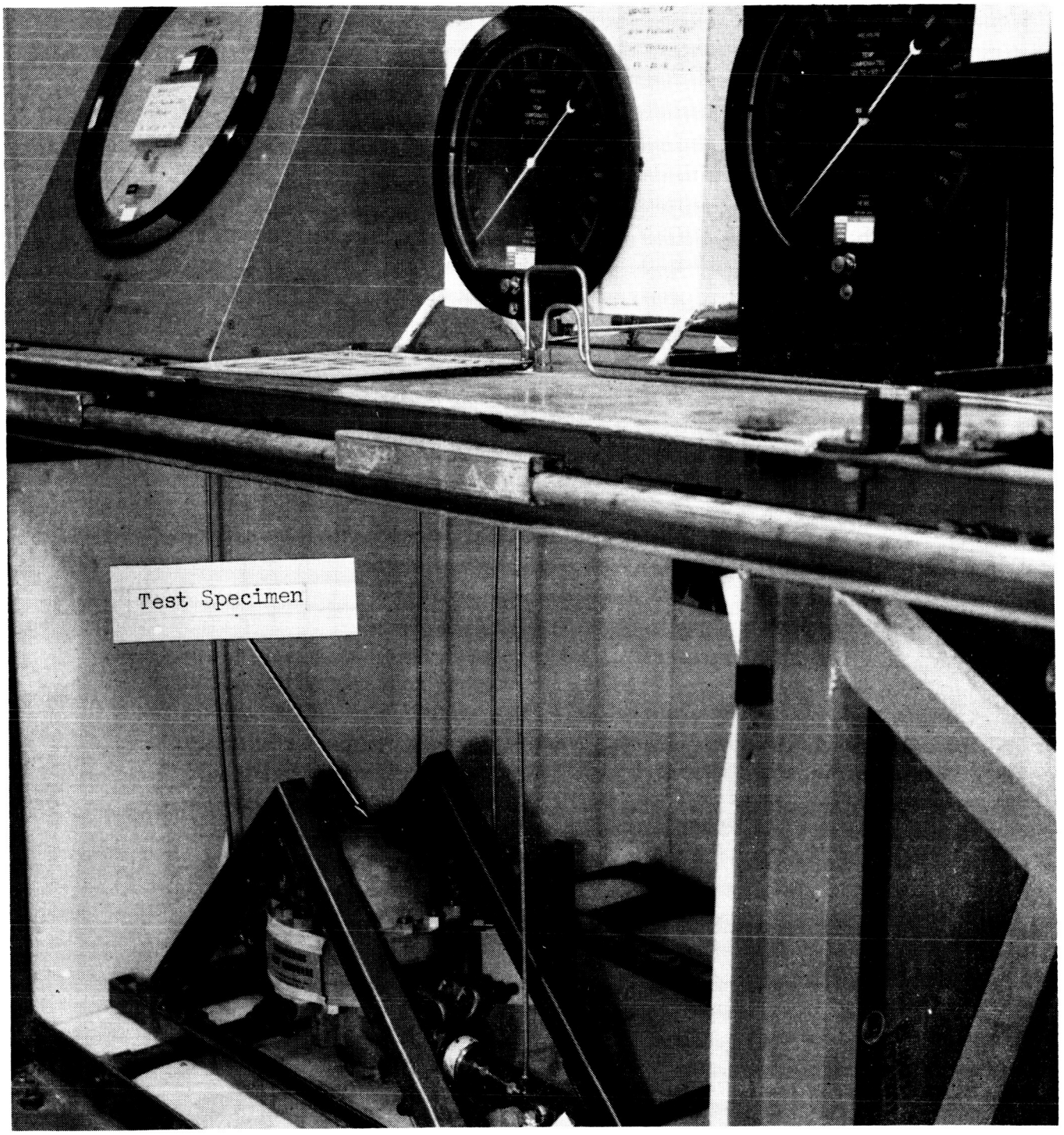


Figure 5-2. Prolonged Pressure Test Setup

SECTION VI

LOW TEMPERATURE TEST

6.1 TEST REQUIREMENTS

6.1.1 A low temperature test will be performed on test specimens 2 and 3 to determine whether the environment causes degradation.

6.1.2 The body of the regulator shall be subjected to a temperature of -65°F and the dome of the regulator exposed to ambient temperature. A flow rate of approximately 1 scfm shall be established with the operating medium at -65°F and at least -65°F dewpoint.*

6.1.3 A functional test shall be performed during this test using GN_2 as the test medium. Leakage will be monitored by noting pressure drop.

6.2 TEST PROCEDURE

6.2.1 The low temperature test setup was assembled as shown in figures 4-1 and 6-1 utilizing the equipment listed in table 4-1.

6.2.2 A functional test was performed because 72 hours or more had elapsed since the previous functional test.

6.2.3 The chamber was controlled to the specified test conditions while maintaining a relative humidity between 60 and 90 per cent.

6.2.4 A functional test was performed when temperature stabilization was obtained. Temperature stabilization is defined as a maximum temperature change rate of 4°F per hour as determined from the instrumentation monitoring the test specimen.

6.2.5 The specimen was returned to ambient conditions. Within one hour following the return of the specimen to ambient conditions, the test specimen was visually inspected and functionally tested.

6.2.6 The test data were recorded.

6.3 TEST RESULTS

Specimens 2 and 3 were subjected to the low temperature test environment. Both specimens had excessive external leakage when the dome was pressurized. The leakage occurred between the dome and body approximately 90° from the flow axis. It was determined that the external leakage occurred at specimen temperatures of +5°F and below. Some of the body bolt torques were below the specified value.

* Note: The rated low temperature was originally +5°F.

6.4 TEST DATA

6.4.1 All low temperature test functional data are presented in tables 6-1 through 6-7.

6.4.2 Body bolt torque values for specimen 3 at ambient and low temperature are presented in table 6-8.

Table 6-1. Specimen 2 Functional Test Data Prior To Low Temperature Test

Test	Procedure Reference Paragraph	Media: Allowable Value	N_2	N_2
Seat Leakage	4.1.1	10 sccm	0	0
External Leakage	4.1.1	No leakage	0	0
Reverse Dome Leakage	4.1.2	No leakage	0	0
Forward Dome Leakage	4.1.3	No leakage	0	0
Actual Dome Pressure	4.1.4	±5% of calculated	765	760
Calculated Dome Pressure	4.1.4		765	765
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK	OK
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm	0	0
Actual Dome Pressure	4.1.4	±5% of calculated	1510	1520
Calculated Dome Pressure	4.1.4		1513	1513
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK	OK
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm	0	0
Actual Dome Pressure	4.1.4	±5% of calculated	3000	3005
Calculated Dome Pressure	4.1.4		3009	3009
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK	OK
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm	0	0

Table 6-2. Specimen 2 Functional Test Data At -65°F Low Temperature Test

Test	Procedure Reference Paragraph	Media: Allowable Value	N_2
Seat Leakage	4.1.1	10 sccm	0
External Leakage	4.1.1	No leakage	0
Reverse Dome Leakage	4.1.2	No leakage	0
Forward Dome Leakage	4.1.3	No leakage	0*
Actual Dome Pressure	4.1.4	±5% of calculated	760
Calculated Dome Pressure	4.1.4		765
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	1500
Calculated Dome Pressure	4.1.4		1513
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	3000
Calculated Dome Pressure	4.1.4		3009
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm	0

* Note: External leakage excessive between dome and body.

Table 6-3. Specimen 2 Functional Test Data After -65°F Temperature Test

Test	Procedure Reference Paragraph	Allowable Value	Media N_2
Seat Leakage	4.1.1	10 sccm	0
External Leakage	4.1.1	No leakage	0
Reverse Dome Leakage	4.1.2	No leakage	0
Forward Dome Leakage	4.1.3	No leakage	0
Actual Dome Pressure	4.1.4	±5% of calculated	760
Calculated Dome Pressure	4.1.4		765
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	1510
Calculated Dome Pressure	4.1.4		1513
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	3000
Calculated Dome Pressure	4.1.4		3009
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm	0

Table 6-4. Specimen 3 Functional Test Data Prior To Low Temperature Test

Test	Procedure Reference Paragraph	Media: Allowable Value	N_2
Seat Leakage	4.1.1	10 sccm	0
External Leakage	4.1.1	No leakage	0
Reverse Dome Leakage	4.1.2	No leakage	0
Forward Dome Leakage	4.1.3	No leakage	0
Actual Dome Pressure	4.1.4	±5% of calculated	865
Calculated Dome Pressure	4.1.4		855
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	1600
Calculated Dome Pressure	4.1.4		1590
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	3060
Calculated Dome Pressure	4.1.4		3060
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm	0

Table 6-5. Specimen 3 Functional Test Data At +5°F Low Temperature Test

Test	Procedure Reference Paragraph	Media Allowable Value	N_2
Seat Leakage	4.1.1	10 sccm	0
External Leakage	4.1.1	No leakage	0
Reverse Dome Leakage	4.1.2	No leakage	0
Forward Dome Leakage	4.1.3	No leakage	0
Actual Dome Pressure	4.1.4	±5% of calculated	900
Calculated Dome Pressure	4.1.4		855
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK*
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	1570
Calculated Dome Pressure	4.1.4		1590
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm	0
Actual Dome Pressure	4.1.4	±5% of calculated	3040
Calculated Dome Pressure	4.1.4		3060
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm	Large ** external leak

* Note: Sample operated eratically while dome was being pressurized.
** Note: External leak developed between dome and body 90° from flow direction when seat leakage measurement was attempted.

Table 6-6. Specimen 3 Functional Test Data After +5°F Low Temperature Test

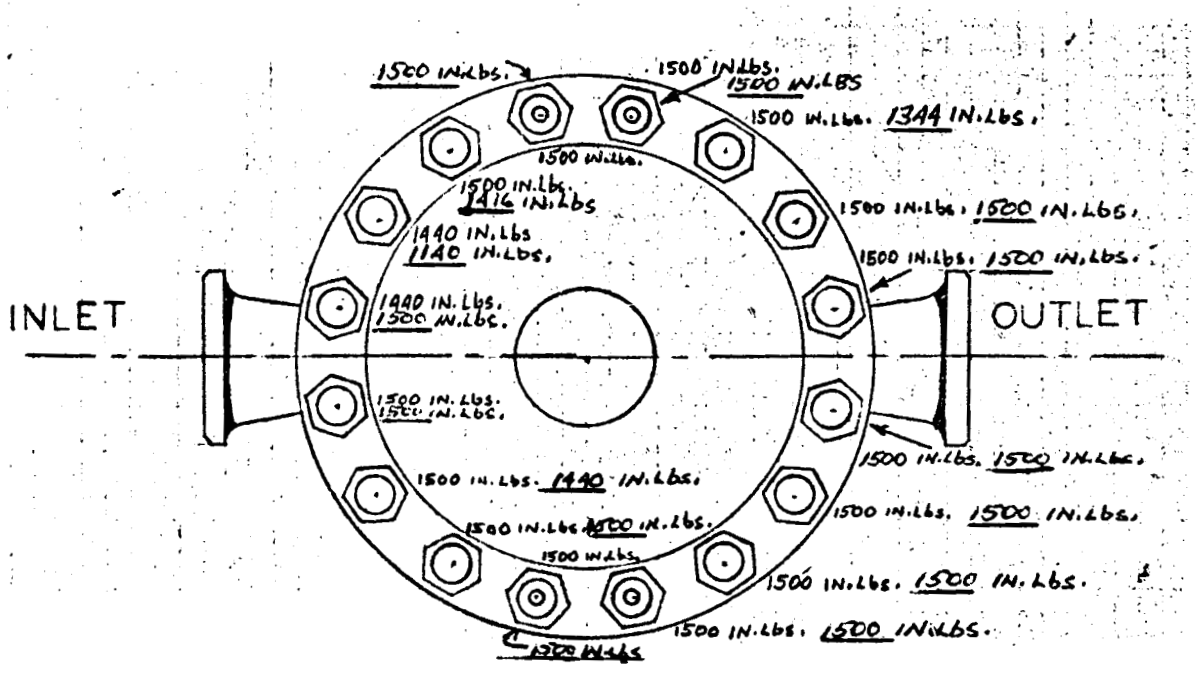
Test	Procedure Reference Paragraph	Media: Allowable Value	N_2	N_2
Seat Leakage	4.1.1	10 sccm	0	0
External Leakage	4.1.1	No leakage	0	0
Reverse Dome Leakage	4.1.2	No leakage	0	0
Forward Dome Leakage	4.1.3	No leakage	0	0
Actual Dome Pressure	4.1.4	±5% of calculated	860	860
Calculated Dome Pressure	4.1.4		855	855
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK	OK
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm	0	0
Actual Dome Pressure	4.1.4	±5% of calculated	1570	1600
Calculated Dome Pressure	4.1.4		1590	1590
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK	OK
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm	0	0
Actual Dome Pressure	4.1.4	±5% of calculated	3070	3060
Calculated Dome Pressure	4.1.4		3060	3060
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK	OK
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm	0	0

Table 6-7. Specimen 3 Functional Test Data During -65°F Low Temperature Test

Test	Procedure Reference Paragraph	Media Allowable Value	N_2	
Seat Leakage	4.1.1	10 sccm	0	
External Leakage	4.1.1	No leakage	0	
Reverse Dome Leakage	4.1.2	No leakage	0	
Forward Dome Leakage	4.1.3	No leakage	0*	
Actual Dome Pressure	4.1.4	±5% of calculated	-------	Test Stopped
Calculated Dome Pressure	4.1.4			
Regulator Stability	4.1.4	±2% of dome and outlet pressure		
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm		
Actual Dome Pressure	4.1.4	±5% of calculated		
Calculated Dome Pressure	4.1.4			
Regulator Stability	4.1.4	±2% of dome and outlet pressure		
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm		
Actual Dome Pressure	4.1.4	±5% of calculated		
Calculated Dome Pressure	4.1.4			
Regulator Stability	4.1.4	±2% of dome and outlet pressure		
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm		

* Note: External leakage excessive between dome and body.

Table 6-8. Body Bolt Torque Values For Specimen 3 At Ambient And Low Temperature



Specified Torque - 1500 in/lbs

Torque values underlined are
at low temperature (5°F)

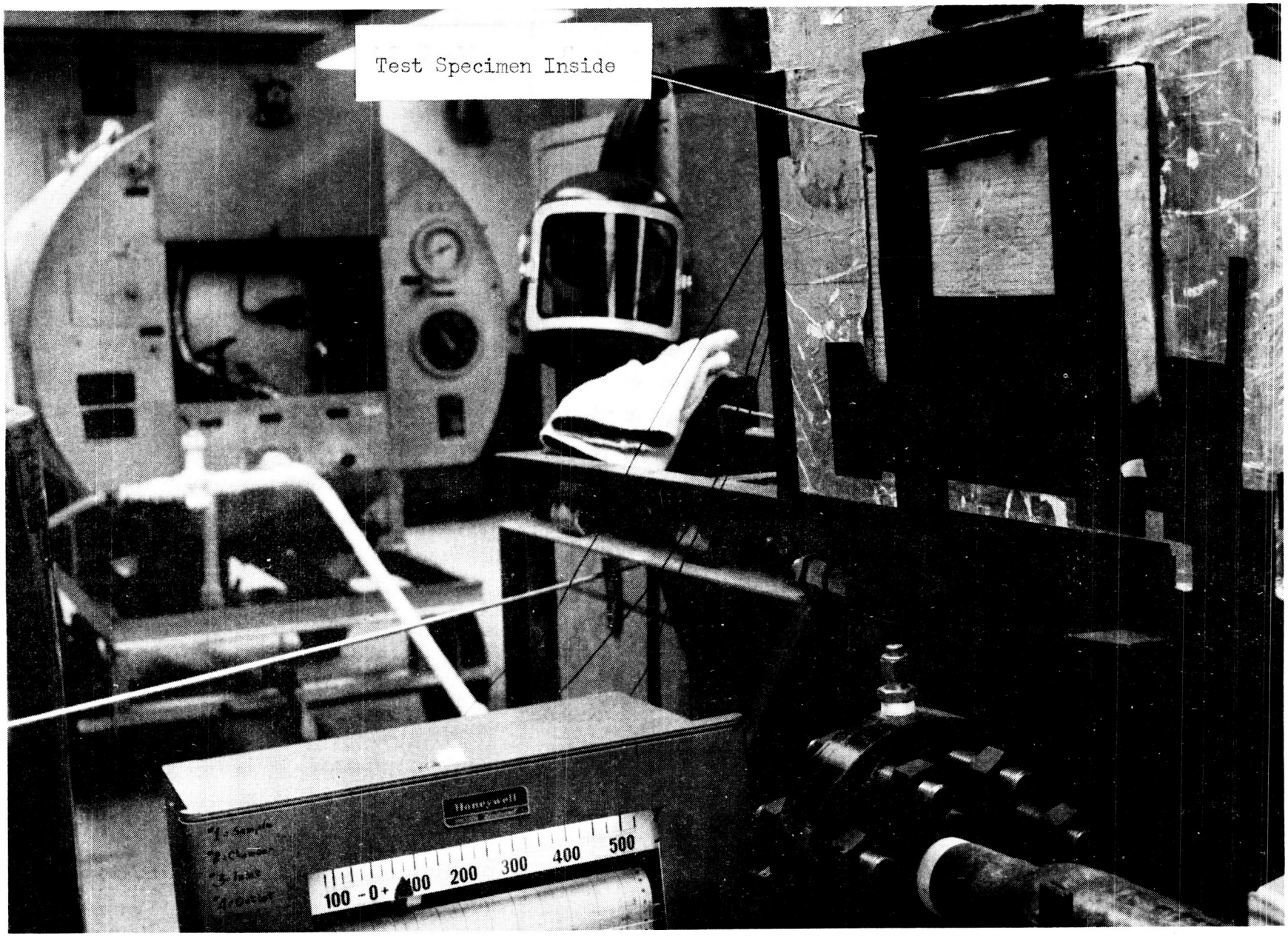


Figure 6-1. Low Temperature Test Setup

SECTION VII

HIGH TEMPERATURE TEST

7.1 TEST REQUIREMENTS

7.1.1 A high temperature test will be performed on test specimens 2 and 3 to determine whether the environment causes degradation.

7.1.2 The rated high temperature is 160 (+4, -0)°F.

7.1.3 A functional test shall be performed using GN_2 as the test medium during this test.

7.2 TEST PROCEDURE

7.2.1 The high temperature test setup was assembled as shown in figures 4-1 and 7-1 using the equipment listed in table 4-1.

7.2.2 The chamber was controlled to the specified test conditions while maintaining a relative humidity of 20 per cent ($\pm$5 per cent).

7.2.3 The temperature was maintained at 160 (+4, -0)°F for 72 (+2, -0) hours.

7.2.4 A functional test was conducted while the chamber temperature was maintained.

7.2.5 The chamber temperature was returned to ambient conditions upon completion of the functional test.

7.2.6 Within one hour following the return of the specimen to ambient conditions, the specimen was visually inspected and functionally tested.

7.2.7 Test data were recorded.

7.3 TEST RESULTS

7.3.1 Specimens 2 and 3 were subjected to the high temperature test environment. Both specimens had excessive external body plug leakage during and after the test.

7.3.2 The body bolt torque values dropped off considerably at high temperature. The torque value of specimen 2 was 75 ft-lbs at 160°F. The torque value of specimen 3 was 133 ft-lbs at 160°F.

7.4 TEST DATA

7.4.1 Functional data on specimens 2 and 3 are presented in tables 7-1 through 7-4.

Table 7-1. Specimen 2 Functional Test Data During High Temperature Test

Run			1	2	3
Media			N_2	N_2	N_2
Test	Procedure Reference Paragraph	Allowable Value	Actual Value		
Seat Leakage	4.1.1	10 sccm	0		
External Leakage	4.1.1	No leakage	Excessive leakage*		
Reverse Dome Leakage	4.1.2	No leakage	0		
Forward Dome Leakage	4.1.3	No leakage	0		
Actual Dome Pressure	4.1.4	±5% of calculated	765		
Calculated Dome Pressure	4.1.4		765		
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK		
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm	0		
Actual Dome Pressure	4.1.4	±5% of calculated	1520		
Calculated Dome Pressure	4.1.4		1513		
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK		
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm	0		
Actual Dome Pressure	4.1.4	±5% of calculated	3010		
Calculated Dome Pressure	4.1.4		3009		
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK		
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm	0		

* Excessive external body plug leakage due to low torque value at high temperature (75 ft-lbs). The body plug was re-torqued to 180 ft-lbs.

Table 7-2. Specimen 2 Functional Test Data After High Temperature Test

		Run	1	2	3
		Media	N_2	N_2	N_2
Test	Procedure Reference Paragraph	Allowable Value	Actual Value		
Seat Leakage	4.1.1	10 sccm	0		
External Leakage	4.1.1	No leakage	Excessive leakage		
Reverse Dome Leakage	4.1.2	No leakage	--- Test	Stopped	---
Forward Dome Leakage	4.1.3	No leakage			
Actual Dome Pressure	4.1.4	±5% of calculated			
Calculated Dome Pressure	4.1.4				
Regulator Stability	4.1.4	±2% of dome and outlet pressure			
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm			
Actual Dome Pressure	4.1.4	±5% of calculated			
Calculated Dome Pressure	4.1.4				
Regulator Stability	4.1.4	±2% of dome and outlet pressure			
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm			
Actual Dome Pressure	4.1.4	±5% of calculated			
Calculated Dome Pressure	4.1.4				
Regulator Stability	4.1.4	±2% of dome and outlet pressure			
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm			

Table 7-3. Specimen 3 Functional Test Data During High Temperature Test

Run			1	2	3
Media			N_2	N_2	N_2
Test	Procedure Reference Paragraph	Allowable Value	Actual Value		
Seat Leakage	4.1.1	10 sccm	0		
External Leakage	4.1.1	No leakage	Excessive leakage*		
Reverse Dome Leakage	4.1.2	No leakage	0		
Forward Dome Leakage	4.1.3	No leakage	0		
Actual Dome Pressure	4.1.4	±5% of calculated	860		
Calculated Dome Pressure	4.1.4		855		
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK		
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm	0		
Actual Dome Pressure	4.1.4	±5% of calculated	1595		
Calculated Dome Pressure	4.1.4		1590		
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK		
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm	0		
Actual Dome Pressure	4.1.4	±5% of calculated	3060		
Calculated Dome Pressure	4.1.4		3060		
Regulator Stability	4.1.4	±2% of dome and outlet pressure	OK		
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm	0		

* Excessive external body plug leakage due to low torque value at high temperature (133 ft-lbs). The body plug was re-torqued to 180 ft-lbs. The body plug leakage was still 20 scim.

Table 7-4. Specimen 3 Functional Test Data After High Temperature Test

Run			1	2	3
Media			N_2	N_2	N_2
Test	Procedure Reference Paragraph	Allowable Value	Actual Value		
Seat Leakage	4.1.1	10 sccm	0		
External Leakage	4.1.1	No leakage	0		
Reverse Dome Leakage	4.1.2	No leakage	0		
Forward Dome Leakage	4.1.3	No leakage	0		
Actual Dome Pressure	4.1.4	±5% of calculated	*		
Calculated Dome Pressure	4.1.4		--- Test Stopped ---		
Regulator Stability	4.1.4	±2% of dome and outlet pressure			
Seat Leakage After Cycling 750 psig	4.1.5	10 sccm			
Actual Dome Pressure	4.1.4	±5% of calculated			
Calculated Dome Pressure	4.1.4				
Regulator Stability	4.1.4	±2% of dome and outlet pressure			
Seat Leakage After Cycling 1500 psig	4.1.5	10 sccm			
Actual Dome Pressure	4.1.4	±5% of calculated			
Calculated Dome Pressure	4.1.4				
Regulator Stability	4.1.4	±2% of dome and outlet pressure			
Seat Leakage After Cycling 3000 psig	4.1.5	10 sccm			

* As inlet pressure was increased the body plug began to leak excessively.

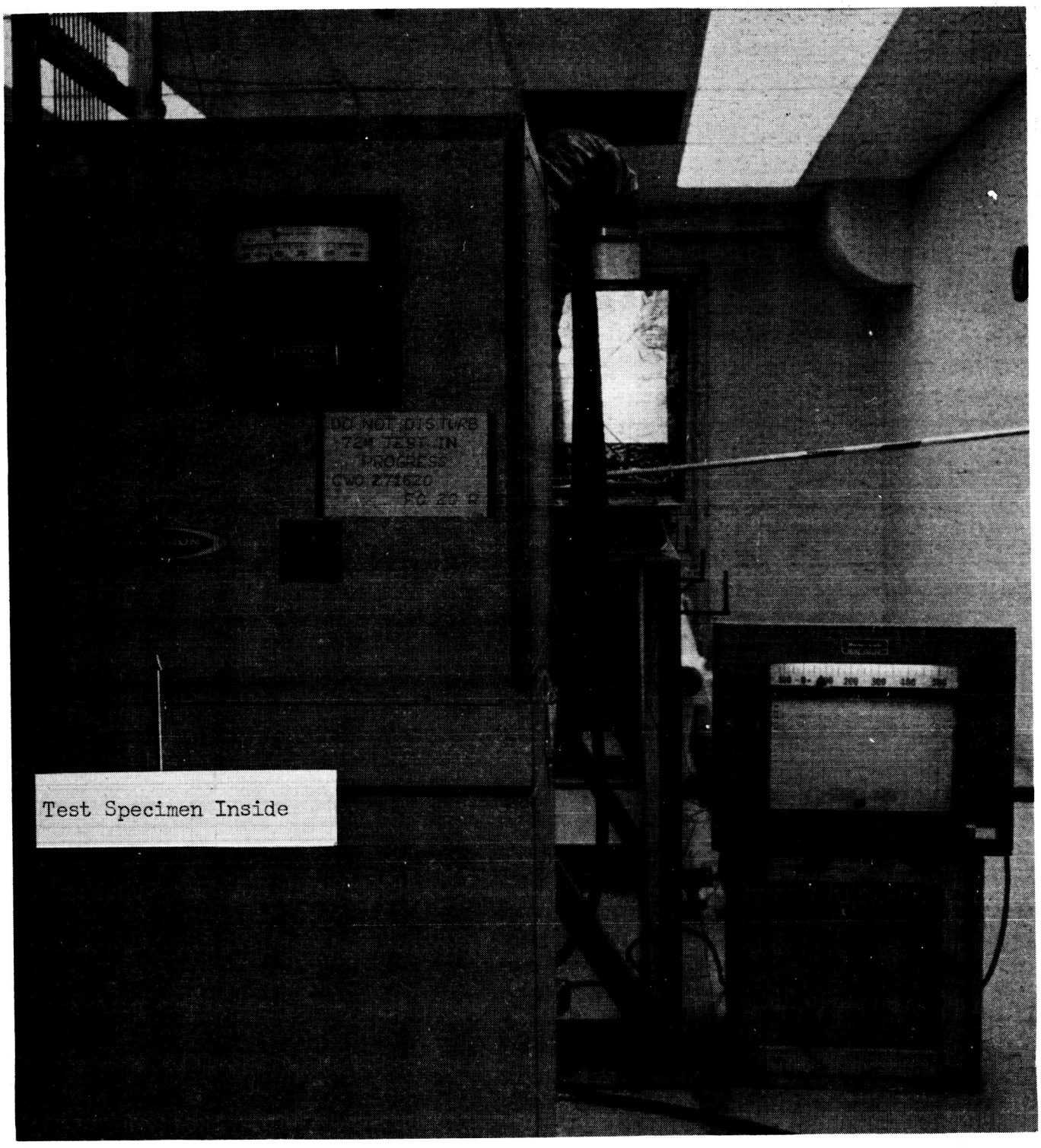


Figure 7-1. High Temperature Test Setup

APPROVAL

TEST REPORT

FOR

PRESSURE REGULATORS

Grove Valve and Regulator Company Part Numbers T-1538 and T-1541

NASA Drawing Numbers B75M50305-1 and B75M50305-4

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